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DRAWINGS ATTACHED

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D1K 20C 20H

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(19)

(54) MATS FOR THE STABILISATION OF DAMS, DYKES, RIVER BANKS, WATERWAYS, DITCHES AND THE LIKE

(71) We, E.A.H. NAUE K.G., ROSSHAARSPINNEREI, GUMMIHAAR- UND SCHAUMPOLSTERFABRIK, a German firm, of 4992 Espelkamp über Lübbecke, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to mats for the stabilisation of dams, dykes, river banks, waterways, ditches and the like, and is concerned in particular with such mats comprising a layer of matted non-woven synthetic fibres.

Mats comprising loose non-woven layers of synthetic fibres bonded by means of sea water- and chemical-resistant adhesives are known. Such mats can if desired be reinforced by a layer of a backing fabric which can either be embedded in the non-woven layer or secured to one side thereof. Alternatively the non-woven layer can be compressed on one side or can be rolled to give a compressed mat. Another way of reinforcing these mats involves stamping selected areas of the mat to compress the mass of fibres. The mat weight can if desired be increased by the inclusion of fillers.

The reinforcement methods referred to above do improve the functioning of the mats, and mats reinforced in this way function more satisfactorily for example in holding back sand. It has been found, however, that the reinforcement may not be entirely satisfactory when the mats are used for retaining canal banks and walls. When a temporary high pressure results from water movement caused by a ship's propeller or by water displacement caused by a ship's hull or by storms, and water is forced against the banks so that the water level rises above the normal water line and flows back spasmodically, earth on the bank is continuously loosened. Small earth particles thus tend to be washed away with consequent erosion of the bank, and this effect is especially marked where mats comprising loosely mater non-woven fibres are concerned.

Mats described in our Specification No. 1,213,428 may have a lattice of a synthetic fibre fabric welded to the layer of non-woven fibres. Such mats do function to reduce erosion and in general have a good retaining capacity, but it has been found that the lattice can become detached from the non-woven layer after prolonged use.

It is an object of the present invention to provide an improved mat for use in retaining the banks of dams, dykes, rivers, waterways, ditches and the like.

According to the present invention, there is provided a mat for use in retaining the banks of dams, dykes, rivers, waterways, ditches and the like which comprises a layer of matted non-woven randomly orientated synthetic fibres and a layer of porous reinforcing backing, fibres of the non-woven layer being looped through the backing whereby there is a layer of loops of the synthetic fibres on at least one surface of the mat.

[*Price 25p*]

The backing may for example be provided by a welded lattice fabric. A large number of the synthetic fibres of the non-woven layer are needled through the lattice and on the reverse side form a layer of loops similar to the loop pile of tufted carpets. After subsequent application of a sea water- and chemical-resistant binder or the binding of the fibres by inclusion therewith and subsequent melting of lower melting fibres, a mat having high durability and good filtering action can be produced.

The reinforcing backing can also be provided by a layer of compressed matted non-woven synthetic fibres. A large number of the fibres of the uncompressed non-woven layer are then needled through the compressed layer, forming a layer of loops on the reverse side.

Where mats having especially good retaining properties are required it may be advantageous to incorporate two reinforcing backings, e.g. two layers of a welded lattice fabric or of compressed fibres.

An advantage of the mats according to the invention is that the open passages in the mesh of the lattice backing or between the fibres of a compressed non-woven material are so constricted that fine sand or other earth particles on banks protected by the mats are in general retained and erosion is thus satisfactorily inhibited.

According to a further feature of the invention, a layer of open-cell cellular plastics material may be incorporated in the mat. If desired, the cellular material can be used as the reinforcing backing; alternatively it can be present in addition to a backing such as described above. The fibres of the non-woven layer can be needled in accordance with the invention through the layer of cellular material to form a layer of loops on the reverse side. As the material open-celled, water can pass through it but sand or other fine earth particles cannot and are thus retained. This is particularly important when water which has penetrated the mat or has flushed on to the slopes of the river bank after passage of a ship or ebbing of the waves tries to flow back rapidly and to carry the loose sand or other fine earth particles with it. This is also important when the mats are used to protect drainage ditches. The water flowing from the land into the drainage ditches cannot carry sand or other fine earth particles through the mat, and thus the tendency of drainage ditches to overflow can be reduced.

Alternatively, the layer of non-woven synthetic fibres may be completely embedded in a lattice of the cellular plastics material. The synthetic fibres are, as in the other mats of the invention, needled through the outer surface of the cellular material, but in this case the backing also extends throughout the mat. Such mats are more tear-resistant than mats of cellular material alone.

The mats of the invention also may comprise several superimposed layers of matted non-woven synthetic fibres, the fibres of different layers being of different fibre diameters, different fibre types and/or different fibre densities, whereby the individual layers have a different filter action.

It is to be understood that the backing of the mats of the invention may be formed *in situ* from the fibres of the non-woven layer, e.g. by impregnation of the surface with binders by means of rollers having a relief surface, so that binding takes place in selected areas, in punctiform manner or in square or diamond shaped areas. This technique provides a lattice of bonded fibres through which other fibres can be needled.

The application of a binder in this way gives the surface of the mat a relief pattern corresponding to that of the roller. Fillers may be included in the binder, and these may advantageously be used to produce mats having a density of more than 1.0. The mats of the invention may be joined together when a larger system is required.

Obviously the mats according to the invention can additionally be profiled in order to obtain a further increase in the tensile strength, tear resistance and filter capacity.

The invention will now be further described by reference to the accompanying drawings.

Fig. 1 shows in cross-section a mat having a layer (1) of matted non-woven synthetic fibres and a backing (2) of a fabric lattice. The fibres are needled through the backing (2) to give a layer (3) of loops on the underside.

Fig. 2 shows in cross-section a mat having a layer (1′) similar to that of Fig. 1 needled to a strip of cellular plastics material (4) which is protected by a layer of compressed matted non-woven synthetic fibres (5). The fibres of the layer (1) are needled through the backing layers (4) and (5) to provide a layer of loops (3) on the underside of the mat.

Fig. 3 shows in cross-section a mat having a layer (1′), similar to that of Fig. 1, needled through two backings (2*a*) and (2*b*), the backings being lattices of fabric or compressed matted non-woven synthetic fibres, so that two layers of loops (3) are provided on both surfaces of the mat.

Fig. 4 shows in cross-section a mat having a layer of matted non-woven synthetic fibres (1′) which is completely embedded in a lattice of an open-celled cellular plastics material (6) through which it is subsequently needled.

Fig. 5 shows in cross-section a mat comprising four layers (*a*, *b*, *c*, *d*) of matted non-woven synthetic fibres, the individual layers being adhesively bonded, welded, needled or felted to the adjacent layers; the lowest layer is subsequently needled through a backing.

Figs. 6*a*—6*e* show plan views of layers of matted non-woven synthetic fibres which are

impregnated with a binder in various relief patterns and compressed. These patterns can be varied and extended as desired.

Fig. 7 shows in cross-section a mat having backing layers of binder-impregnated layers of compressed matted non-woven synthetic fibres (6) which are superimposed on one another. A layer (1) of matted non-woven synthetic fibres is needled through the backing, and on its other side has (and is optionally needled to) a layer of finer and denser matted non-woven synthetic fibres.

The mats of the invention are conveniently about 2 metres wide, whilst in practice continuous width are required. To obtain a wider mat from the 2 metre-wide mats, the narrower mats may be joined together in any convenient manner.

It is desirable to provide the wider (e.g. 12—20 metres wide) mats with several anchorage points on their undersides and also to give more support for a covering of stones, sand bags or the like when the mats are for use on the inclined plane. The mats of the invention may therefore be joined together with seams which provide anchorage points.

For example, the outer edges of a plurality of mats of the invention method securely connected to one another by means of sewing, clips, welding or some other method. As shown in cross-section in Fig. 8 a (Leporello) folded stack is obtained which can be opened out *in situ* in such a way that the projecting seams are alternately on the top and underside of the mat assembly. With this arrangement, the underside seams serve to anchor the mat to the bank and the topside seams serve to support for example stones placed on top of the mats to keep them in position.

The size of such a mat arrangement is only limited by its transportability.

As shown in Figs. 8 and 8*a* (which shows the arrangement of Fig. 8 when extended) a number of mats (e.g. 81, 82, 83, 84) are joined together with seams of a depth as indicated by 85 and 86. The horizontal lines through the seams in Fig. 8*a* indicate the point of attachment. Fig. 8*b* is a cross-section of the arrangement of Fig. 8*a* in use on a sloping bank and weighed down with stones 88.

Larger and stronger projecting seams may be provided by interposing an intermediate layer of the same or different material between the side edges of the mats where they are to be joined together. Figs. 9, 9*a* and 9*b*, which show sections equivalent to Figs. 8—8*b*, shows such an arrangement having an intermediate layer 90 in the joint between adjacent mats.

To increase the stability, improve the anchorage to the ground and increase the filter action, this intermediate layer can be in the form of a single or double loop (100), as shown in Figs. 10, 10*a* and 10*b*, which again show sections equivalent to those of Figs. 8—8*b*.

Finally the mat can be folded at right angles to the longitudinal direction and the individual layers at the fold (12) can be permanently quilt-seamed, adhesively bonded or welded together if good anchorage is important, as shown in section in Figs. 11*a* and 11*b*.

WHAT WE CLAIM IS:—

1. A mat for use in retaining the banks of dams, dykes, rivers, waterways, ditches and the like which comprises a layer of matted non-woven randomly orientated synthetic fibres and a layer of porous reinforcing backing, fibres of the non-woven layer being looped through the backing whereby there is a layer of loops of the synthetic fibres on at least one surface of the mat.

2. A mat as claimed in claim 1 wherein the backing comprises a welded lattice fabric.

3. A mat as claimed in claim 1 wherein the backing comprises a layer of compressed matted non-woven synthetic fibres.

4. A mat as claimed in any one of claims 1 to 3 wherein a layer of open-cell cellular plastics material is incorporated in the mat.

5. A mat as claimed in claim 1 wherein the backing comprises an open-cell cellular plastics material.

6. A mat as claimed in any of the preceding claims which comprises two layers of backing.

7. A mat as claimed in any one of the preceding claims wherein there is a plurality of layers of matted non-woven synthetic fibres, the fibres of different layers having varying thicknesses and/or densities.

8. A mat as claimed in claim 3 wherein the layer of compressed synthetic fibres includes a binder (which may optionally contain a filler) in selected areas.

9. A mat as claimed in claim 8 wherein the binder contains fillers such that the density of the mats exceeds 1.0.

10. An arrangement of mats comprising a plurality of mats as claimed in any of the preceding claims joined along adjacent outer edges.

11. An arrangement of mats as claimed in claim 10 wherein the mats are joined to provide projecting seams..

12. A mat or arrangement of mats as claimed in any of the preceding claims substantially as herein described.

13. A mat or arrangement of mats for use in retaining the banks of dams, dykes, rivers, waterways, ditches and the like substantially as herein described with reference to any of the accompanying drawings.

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1319603 COMPLETE SPECIFICATION

6 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

FIG.1.

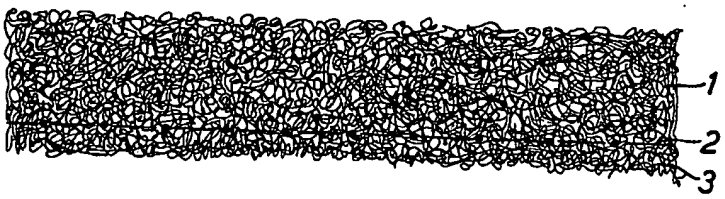


FIG.2.

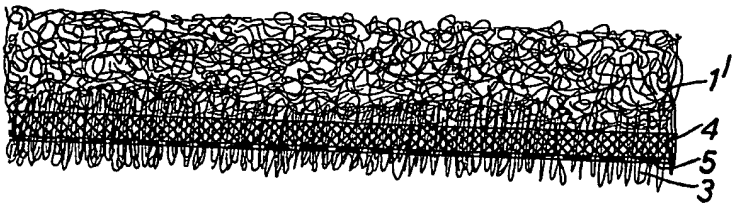


FIG.3.

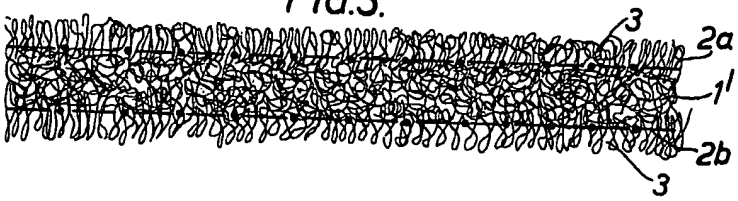


FIG.4.

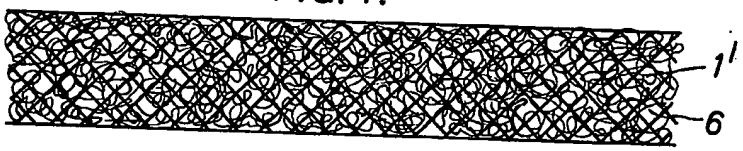


FIG.5.

1319603 COMPLETE SPECIFICATION

6 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 2

FIG.6a.

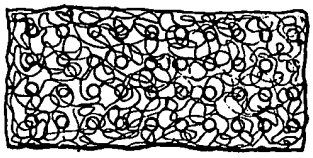


FIG.6b.

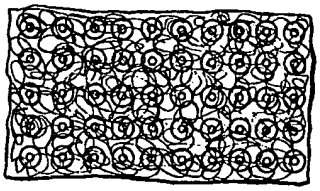


FIG.6c.

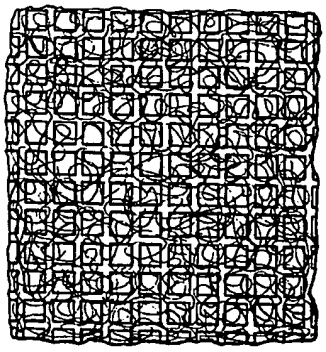


FIG.6d.

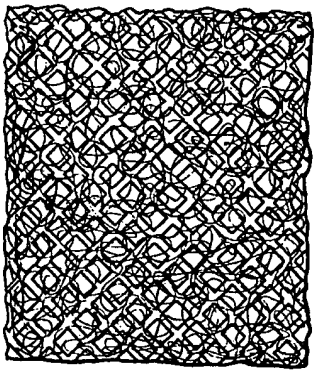
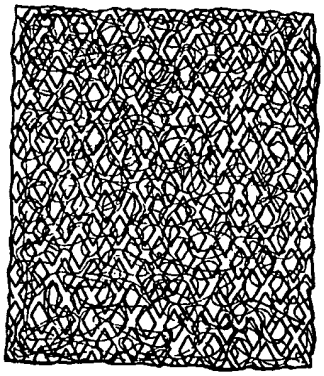


FIG.6e.



1319603 COMPLETE SPECIFICATION
6 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 3

FIG. 7.

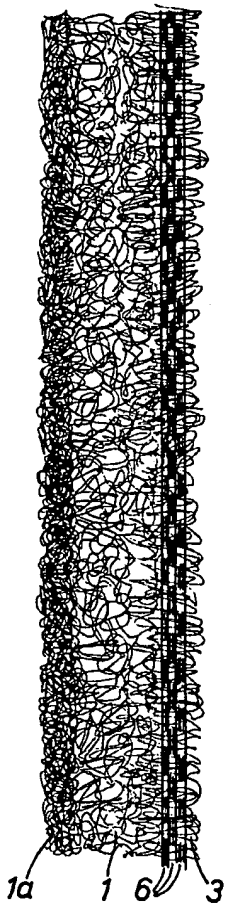


FIG. 8.

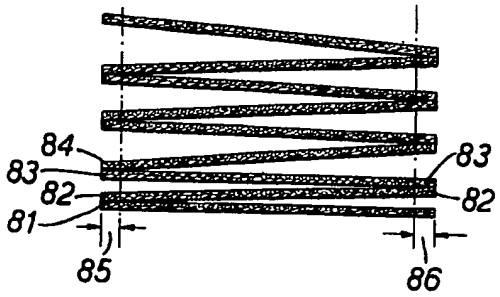


FIG. 8a.

FIG. 8b.

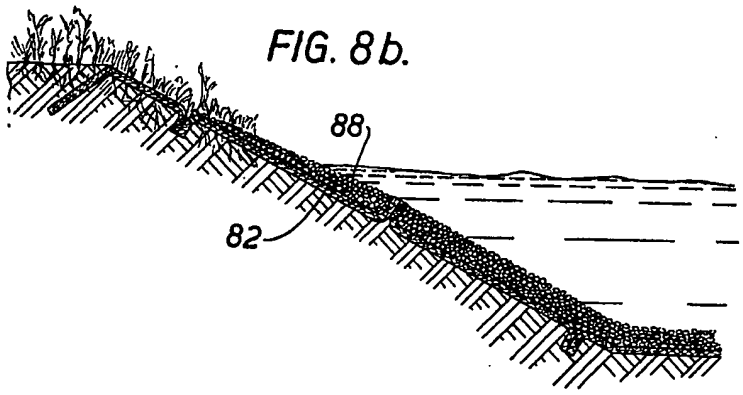


FIG. 9.

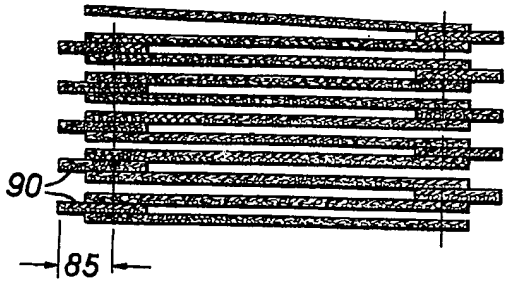


FIG.9a.

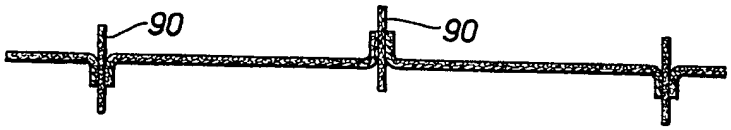


FIG. 9b.

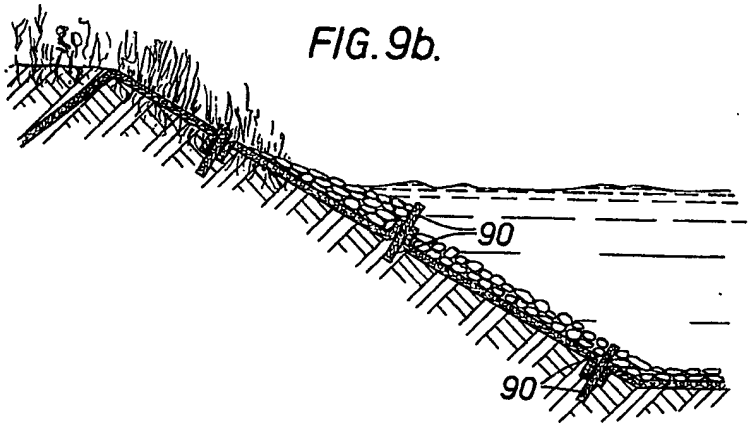


FIG. 10.

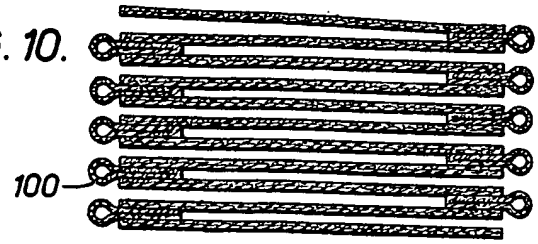


FIG. 10a.

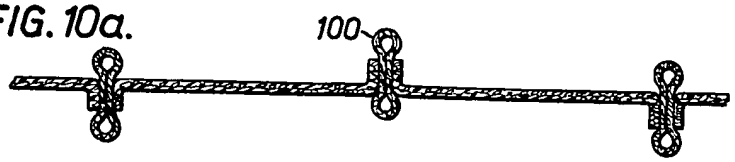


FIG.10b.

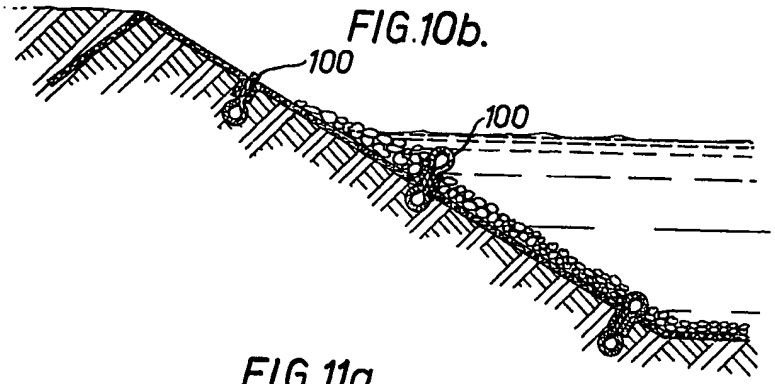


FIG.11a.

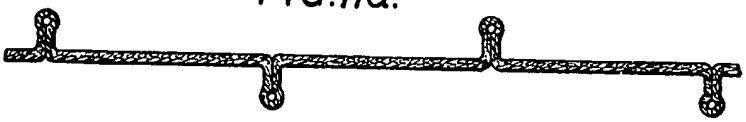


FIG.11b.